REMARKS

Claims 43-60 are in the application.

Claims 1-42 are cancelled by preliminary amendment.

An early examination on the merits is respectfully requested.

Respectfully submitted,

By

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NEW PARAGRAPH, PAGE 1, LINE 1

The present application is a continuation of U.S. Patent Application Ser. 09/248,022, filed February 10, 1999, now US 6,633,226, which is a continuation of U.S. Patent Application Ser. 08/914,282, filed August 18, 1997, now US 6,114,971.

The embodiment of FIG. [13] 1 comprises a substrate [220] 120 of piezoelectric material, such as lithium niobate, on which is deposited a pattern of metallization essentially as shown. The metallization includes two bus bars [222 and 224] 122 and 124 for the transmission of electrical energy to four launch transducers [226, 228, 230 and 232] 126, 128, 230 and 232. These launch transducers are staggered, with respect to each other, with their leading edges separated by distances X, Y and Z, respectively, as shown. The distances X and Z are identical; however, the distance Y is larger than X and Z in order to provide temporal separation of the received signals corresponding to the respective signal paths. Further metallization includes four parallel rows of delay pads [234, 236, 238 and 240] 134, 136, 138 and 140 and four parallel rows of reflectors [242, 244, 246 and 248] 142, 144, 146 and 148. The two rows of reflectors [244 and 246] 144 and 146 which are closest to the transducers are called the "front rows" whereas the more distant rows [242 and 248] 142 and 148 are called the "back rows" of the transponder. The bus bars [222 and 224] 122 and 124 include contact pads [250 and 252] 150 and 152, respectively, to which are connected the associated poles [254 and 256] 152 and 156 of a dipole antenna. These two poles are connected to the contact pads by contact elements or wires [258 and 260] 158 and 160, represented in dashed lines.

The provision of four transducers [226, 228, 230 and 232] 126, 128, 130 and 132 and two rows of reflectors [242, 244, 246, and 248] 142, 144, 146, and 148 on each side of the transducers results in a total of sixteen SAW pathways of different lengths and, therefore, sixteen "taps". These sixteen pathways (taps) are numbered 0, 1, 2 ... D, E, F, as indicated by the reference number (letter) associated with the individual reflectors. Thus, pathway 0 extends from transducer 226 to reflector 0 and back again to transducer [226] 126. Pathway 1 extends from transducer 228 to reflector 1 and back again to transducer [228] 128. The spatial difference in length between pathway 0 and pathway 1 is twice the distance X (the offset distance between transducers [226 and 228] 126 and 128). This results in a temporal difference of ΔT in the propagation time of surface acoustic waves. Similarly, pathway 2 extends from transducer [226] 126 to reflector 2 and back again to transducer [226] 126. Pathway 3 extends from transducer [228] 128 to reflector 3 and back to transducer [228] 128. The distance X is chosen such that the

temporal differences in the length of the pathway 2 with respect to that of pathway 1, and the length of the pathway 3 with respect to that of pathway 2 are also both equal to ΔT. The remaining pathways 4, 5, 6, 7 ... E, D, F are defined by the distances from the respective transducers launching the surface acoustic waves to the associated reflectors and back again. The distance Y is equal to substantially three times the distance X so that the differences in propagation times between pathway 3 and pathway 4 on one side of the device, and pathway B and pathway C on the opposite side are both equal to ΔT. With one exception, all of the temporal differences, from one pathway to the next successive pathway are equal to the same ΔT. The SAW device is dimensioned so that ΔT nominally equals 100 nanoseconds. In order to avoid the possibility that multiple back and forth propagations along a shorter pathway (one of the pathways on the left side of the SAW device as seen in FIG. [13] 1) appear as a single back and forth propagation along a longer pathway (on the right side of the device), the difference in propagation times along pathways 7 and 8 is made nominally equal to 150 nanoseconds.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. [13] 1 is a plan view, in enlarged scale, of a [seventh configuration of the] transponder configuration [of FIG. 5].

FIG. [14] 2 is a plan view, in greatly enlarged scale, of a portion of the transponder configuration shown in FIG. [13] 1.

FIG. [15] 3 is a diagram showing the respective time delays of the different SAW pathways in the transponder of FIG. [13] 1.

FIG. [16] 4 is a flow diagram showing the order of calculations carried out by the signal processor.

FIG. [17] 5 is a block diagram of a first embodiment of an acoustic transponder interrogation system according to the present invention.

FIG. [18] 6 is a block diagram of a second embodiment of an acoustic transponder interrogation system according to the present invention, having a plurality of signal generators.

FIGS. [19A1, 19A2 and 19B] 7A1, 7A2 and 7B are a schematic drawings of a single pole R-C integrator, a double pole R-C integrator, and a switched integrator.

FIG. [20] 8 is a flow chart showing the operation sequence of a system according to the present invention.

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Of course, the integrator may be more or less complex. It may be a single pole R-C filter, as shown in Fig. [19A1] 7A1, an active filter (not shown) or digitally controlled integrator having a controlled integration period, as shown in Fig. [19B] 7B, or other type.

The duration of each hop of the signal generator is generally longer than the longest delay in a transponder, as well as the travel delay. Thus, where a maximum delay within a transponder is less than about 10 μS, a stationary frequency dwell period is greater than about 10 μS.

In the preferred embodiment, a single frequency is emitted 240 by signal generator 200. based on an input from the sequence generator 202. as the interrogation signal at any time, which is transmitted to a transponder 200. the modified signal from which is then received 242 by the receiver. mixed 244 in mixer 208 with a representation 218 of the interrogation signal. which is. for example. the signal from the signal generator 203. delayed by delay 208. integrated by integrator 210. analyzed 248 in analyzer 212. which outputs a set of characteristics 214; however, a plurality of such frequencies may be emitted simultaneously or concurrently, as shown in Fig. [18] 6. The interrogation process includes producing a plurality of interrogation frequencies 246. the response to each of which is analyzed 248 and subjected to database lookup 250. to determine the identification to be output 252. The [In that case, the] receiver system may selectively decode one of the frequencies at any given time, or a parallel process established with a plurality of mixers and integrators. Thus, in the later case, a system as shown in Fig. [18] 6 is provided. A control 220 controls a pair of sequence generators 221. 222 which in turn control a pair of signal generators 223. 224 which are, for example, digitally controlled oscillators. The outputs of the signal generators 223. 224 are summed and emitted from a transmitter 226, and interact with a transponder 200. A receiver, 228 receives a modified interrogation signal, which is then fed to a pair of mixers 230. 231 for demodulation with signals corresponding to the individual signal components of the interrogation signal. The outputs of the mixers 230. 231 are individually integrated in integrators 232. 233 and the outputs captured and analyzed in the analyzer 234. The analyzer 234, after acquiring sufficient data and optionally performing consistency checks, outputs a set of characteristics 235 of the transponder. In comparison to the system shown in Fig. [17] 5, the system according to Fig. [18] 6 will obtain sufficient data for an output about twice as fast. In like manner, a greater number of channels may be simultaneously operative, up to the number of different frequencies.